(19)日本国特許庁（JP）　(12) 公開特許公報（A）　(11)特許出願公開番号

特開平5－6564

(43)公開日　平成5年(1993) 1月14日

(51)Int.Cl.⁵	識別記号	庁内整理番号	FI	技術表示箇所
G11B 7/095	C	2106－5D		

審査請求　未請求　請求項の数2(全 6 頁)

(21)出願番号　特願平3－183443

(22)出願日　平成3年(1991) 6月28日

(71)出願人　000004329
日本ビクター株式会社
神奈川県横浜市神奈川区守屋町3丁目12番地

(72)発明者　太田　光比古
神奈川県横浜市神奈川区守屋町3丁目12番地　日本ビクター株式会社内

(72)発明者　今村　吉修
神奈川県横浜市神奈川区守屋町3丁目12番地　日本ビクター株式会社内

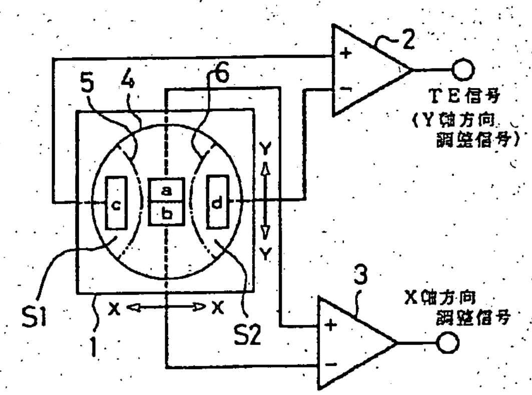
(72)発明者　金田　宜行
神奈川県横浜市神奈川区守屋町3丁目12番地　日本ビクター株式会社内

(54)【発明の名称】　光ディスク読取り装置におけるトラッキング誤差検出方式

(57)【要約】

【目的】　光ディスク読取り装置において、トラッキング誤差(TE)信号をプッシュプル法で検出する場合に、TE信号を高感度で検出すると共に、対物レンズの変位や光ディスクの傾斜に基づく直流オフセットの発生を防止したTE検出方式を提供する。

【構成】　トラッキングサーボ用光検出器1の受光面に対して、対物レンズの変位等が生じても反射光ファーフィールドパターンの0次回折光と1次回折光が重複する領域S1,S2内にTE検出用光センサc,dを配設し、また両センサc,d間の中央部にそれらの配設方向と直交する方向に位置調整用光センサa,bを配設しておき、センサc,dとセンサa,bの出力差を増幅する誤差増幅器2,3の出力が0になるように光検出器1の位置調整を行った後、誤差増幅器2の出力をTE信号としてトラッキングサーボを実行させる。



1

【特許請求の範囲】

【請求項1】　プッシュプル方式によりトラッキング誤差信号を検出する光ディスク読取り装置において、トラッキングサーボ用光検出器の受光面に対して、結像光学系と誤差検出光学系の間で光軸の不一致が生じた場合にも光ディスクからの反射光ファーフィールドパターン内で0次回折光と1次回折光が重複すると想定される2領域内にそれぞれトラッキング誤差検出用光センサを配設すると共に、前記の各光センサ間の中央領域にそれらの光センサの中心を結ぶ線分で分割された2個の位置検出用光センサを配設しておき、トラッキング誤差検出用光センサと位置検出用光センサの各光量検出信号を参照して前記の線分の中点を反射光ファーフィールドパターンの中心に合致させるべくトラッキングサーボ用光検出器の位置を調整固定し、トラッキング誤差検出用光センサの各光量検出信号を用いてトラッキング誤差を検出することを特徴とした光ディスク読取り装置におけるトラッキング誤差検出方式。

【請求項2】　プッシュプル方式によりトラッキング誤差信号を検出する光ディスク読取り装置において、トラッキングサーボ用光検出器の受光面に対して、結像光学系と誤差検出光学系の間で光軸の不一致が生じた場合にも光ディスクからの反射光ファーフィールドパターン内で0次回折光と1次回折光が重複すると想定される2領域内にそれぞれトラッキング誤差検出用光センサを配設すると共に、前記の各光センサ間の中央領域に3分割以上に多分割された位置検出用光センサを配設しておき、各位置検出用光センサの光量検出信号を参照して各トラッキング誤差検出用光センサの中心を結ぶ線分の中点を反射光ファーフィールドパターンの中心に合致させるべくトラッキングサーボ用光検出器の位置を調整固定し、トラッキング誤差検出用光センサの各光量検出信号を用いてトラッキング誤差を検出することを特徴とした光ディスク読取り装置におけるトラッキング誤差検出方式。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は光ディスク読取り装置におけるトラッキング誤差検出方式に係り、シングルビームによるプッシュプル方式でトラッキング誤差(TE)信号を検出する光ディスク装置において、TE信号を高感度で検出すると共に、直流オフセットを発生させない方式を提供することを目的とする。

【0002】

【従来の技術】光ディスク読取り装置においては、レーザビームのトラック追従誤差による再生信号のフレームエラーレート(FER)特性を所定以下に保つためにトラッキングサーボ(TS)システムが組込まれており、ディスクが偏心した状態で動作しても光ピックアップのレーザビームをトラック(1.6μm間隔)に沿って正確にトレースさせるようになっている。このTE信号の検出方式にはシン

2

グルビーム方式や3ビーム方式があり、更にそれぞれの方式においても各種の信号処理方法があるが、プリグルーブの存在確認及び光利用効率についてはプッシュプル方式が最も簡易な構成による方式といえる。

【0003】そして、前記のプッシュプル方式を適用した場合の光ディスク読取り装置は、一例として図4に示すような光学的構成が採用され得る。同図において、光源(レーザダイオード)51から照射されたレーザビームはビームスプリッタ(BS)52を通過してコリメータレンズ53で平行光となり、1/4波長板54を通過した後、対物レンズ55で焦点を絞られて情報記録媒体である光ディスク56の反射面にビームスポットを結ぶ。一方、光ディスク56からの反射光は、逆に対物レンズ55から1/4波長板54とコリメータレンズ53を経てBS52へ戻るが、BS52はその戻り光の角度を90°変更させて隣接したBS57へ入射させ、BS57ではその入射光の一部をそのまま再生信号検出用光検出器58へ入射結像させるが、入射光の他の一部については更に角度を90°変更させてTS用光検出器59へ入射させる。

【0004】プッシュプル方式では、前記の光検出器59は2分割フォトディテクタ(PD)からなり、それぞれのフォトダイオードC,Dの出力差を誤差増幅器60で増幅してTE信号を得ている。ここで、この方式の原理を図5及び図6を用いて詳細に説明する。光ディスク56からの反射光は対物レンズ54から前記の光学系を介して光検出器59の受光面にファーフィールドパターン61を形成するが、光ディスク56の表面にグルーブ(又はピット)62aが形成されていることにより、ファーフィールドパターン61にはグルーブ(又はピット)62aで直接反射される0次回折光63とランド部62bまで入射して波面が曲がった1次回折光64,65との重複領域(斜線領域)S1,S2が形成される。そして、その重複領域S1,S2の光量分布はグルーブ(又はピット)62aの存在による光の干渉効果で大きく変化するため、各領域S1,S2にフォトダイオードC,Dを配設しておくことによりTEを検出できることになる。即ち、光検出器59の受光面の光量分布は、図6の(1)に示すようにグルーブ(又はピット)62aの中心位置にビームスポットがある場合(又はランド部62bの中心にある場合)には分布曲線66のように対称となってTE信号が0Vとなり、一方、図6の(2)に示すようにビームスポットがグルーブ(又はピット)62aからズレた位置にある場合には分布曲線67のように非対称となってTE信号がEV(E≠0)となる。その結果、図7に示すように、光ピックアップの移動につれてTE信号は0Vを中心に変化し、TE信号が0Vになる位置が交互にオントラックとオフトラックを示すことになる。

【0005】

【発明が解決しようとする課題】ところで、前記の原理は図4における結像光学系と誤差検出光学系の光軸が完全に一致していることを前提に成立し、それらの光軸に不一致があるとTE信号に直流オフセットが発生する。例

3

えば、図８に示すように、対物レンズ55が中立状態(光学系で正規位置にある状態)から左又は右に変位(変位量:ω)していた場合には、光検出器59の受光面でファーフィールドパターン61がズレることになり、TE信号に直流オフセットが現われてしまう。また、図９に示すように、ディスク56が対物レンズ55の光軸の直交面から傾斜(傾斜角:θ)していると、反射光の光軸がシフトして同様の結果を招く。即ち、TE信号は、図１０に示すようにオフセット電圧Vosを中心に変化するようになり、その信号が0Vを示していても照射ビームがトラックの中心に位置していないことになる。

【０００６】更に、TE信号の感度を高くするにはファーフィールドパターンの中心に２分割PDの中心(フォトダイオードC,Dの分割線の中点)を合わせる必要があり、従来から光検出器59の各フォトダイオードC,Dの出力を参照しながら調整する方法が採用されているが、その方法によればファーフィールドパターンの中心を分割線上に合わせることは容易であるが、その分割線の中点に位置させることは困難である。即ち、ファーフィールドパターンの中心が前記の分割線上にあれば、各フォトダイオードC,Dは常に同一出力となるために分割線の中点まで求めることができず、分割線上で反射光の光軸と分割線の中点が一致しないことにより光検出器59の感度が低下することになる。

【０００７】そこで、本発明は、プッシュプル方式でTE信号を検出する光ディスク読取り装置において、TS用光検出器がTE信号を常に高感度で検出し、且つそのTE信号に直流オフセットが発生しないTE検出方式を提供することを目的として創作された。

【０００８】

【課題を解決するための手段】第１の発明は、プッシュプル方式によりトラッキング誤差信号を検出する光ディスク読取り装置において、トラッキングサーボ用光検出器の受光面に対して、結像光学系と誤差検出光学系の間で光軸の不一致が生じた場合にも光ディスクからの反射光ファーフィールドパターン内で０次回折光と１次回折光が重複すると想定される２領域内にそれぞれトラッキング誤差検出用光センサを配設すると共に、前記の各光センサ間の中央領域にそれらの光センサの中心を結ぶ線分で分割された２個の位置検出用光センサを配設しておき、トラッキング誤差検出用光センサと位置検出用光センサの各光量検出信号を参照して前記の線分の中点を反射光ファーフィールドパターンの中心に合致させるべくトラッキングサーボ用光検出器の位置を調整固定し、トラッキング誤差検出用光センサの各光量検出信号を用いてトラッキング誤差を検出することを特徴とした光ディスク読取り装置におけるトラッキング誤差検出方式に係る。

【０００９】また、第２の発明は、TS用光検出器の受光面に対するTE検出用光センサの配設条件に関しては第１の発明と同様であるが、位置検出用光センサについては３分割以上に多分割されたものをTE検出用光センサ間の中央領域に配設させ、各位置検出用光センサの光量検出信号を参照して各TE検出用光センサの中心を結ぶ線分の中点を反射光ファーフィールドパターンの中心に合致させるべくTS用光検出器の位置を調整固定し、TE検出用光センサの各光量検出信号を用いてTEを検出することを特徴とした光ディスク読取り装置におけるTE検出方式に係る。

4

【００１０】

【作用】第１の発明では、TS用光検出器の位置を調整するに際して、各TE検出用光センサの光量検出信号を利用してそのセンサの配設方向に係る中点を、位置検出用光センサの各光量検出信号を参照して前記の配設方向に直交する方向に係る中点を求めることができ、TS用光検出器の最高感度位置（両方のTE検出用光センサの対称中心に相当する位置）をファーフィールドパターンの中心に合致させることができる。

【００１１】第２の発明では、前記の位置調整に際して、TE検出用光センサは利用せず、位置検出用光センサのみを用いてファーフィールドパターンの中心を最高感度位置に調整する。即ち、３分割以上の位置検出用光センサの各光量検出信号を用いれば、平面上での最高感度位置を特定することが可能になり、TE検出用光センサを用いることなく位置調整ができる。

【００１２】そして、双方の発明では、対物レンズの変位や光ディスクの傾斜によりファーフィールドパターンがズレたり反射光の光軸がシフトしたりした場合を考慮して、TE検出用センサを反射光ファーフィールドパターン内で０次回折光と１次回折光が重複すると想定される２領域内に位置させてあるため、TE検出用光センサの信号をプッシュプル法で処理することにより常にTE成分のみを検出することが可能になる。即ち、TE信号に直流オフセットが生じることを防止できる。

【００１３】

【実施例】以下、図１から図３を用いて本発明の実施例を説明する。図１は第１の実施例に係る光ディスク読取り装置におけるTS用光検出器の平面図及び信号検出回路を示す。同図において、1はTS用光検出器であり、その受光面にはフォトダイオードであるTE検出用光センサc,dと位置調整用光センサa,bが配設されており、各TE検出用光センサc,dの出力は誤差増幅器2に、各位置調整用光センサa,bの出力は誤差増幅器3に接続されている。また、図１において、X-X方向は光ディスク平面との光学的関係でトラック横断方向を、Y-Y方向はトラック方向を示す。

【００１４】このTS用光検出器1において、各光センサc,d,a,bの配設関係は次のようになっている。先ず、TS用光検出器1を正規の位置に取付けた状態で対物レンズの変位範囲や光ディスクの傾斜範囲を仮定すると、光デ

ィスク読取り装置の光学系を解析することにより、その受光面上には前記の範囲での変位や傾斜があったとしても光ディスクからの反射光ファーフィールドパターン内で0次回折光と1次回折光が重複しているような2領域S1,S2が想定できるが、各TE検出用光センサc,dはそれぞれ前記の2領域S1,S2内に配設されている。尚、図1において、4及び5,6はそれぞれ0次回折光及び1次回折光のパターンを示す。

【0015】一方、位置調整用光センサa,bは、前記の各TE検出用光センサc,dの間に構成される領域の中央部において、各TE検出用光センサc,dの中心を結ぶ線分で分割された態様で配設されている。

【0016】従って、図4に示した光ディスク読取り装置において、従来のTS用光検出器59の代りに図1のTS用光検出器1を仮止めし、トラックの存在しない調整用光ディスクを読取らせた状態で誤差増幅器2,3の各出力が0Vとなるように TS用光検出器1の位置を調整すると、各TE検出用光センサc,dの中心を結ぶ線分の中点に反射光ファーフィールドパターンの中心を合致させることができ、最高感度でのTE検出ができるようになる。即ち、誤差増幅器2の出力はX軸方向の調整信号として、また誤差増幅器3の出力はY軸方向の調整信号として用いることができ、調整用光ディスクの反射光ファーフィールドパターンにおいてはその中心で最大光量となり、且つ周囲の同心円上では中心から遠ざかるにつれて減衰するような光量分布状態になっていることから、誤差増幅器2,3の各出力が0Vとなる位置で最高感度が得られることになる。尚、具体的な調整手段としては、誤差増幅器2,3の出力電圧を電圧計又はオシロスコープ等で計測しながら、位置調整治具を用いてTS用光検出器1の位置を微調整することになる。

【0017】前記のようにしてTS用光検出器1の位置調整が完了すると、その状態でTS用光検出器1を光ピックアップのアッセンブリ機構に完全固定し、通常の光ディスクを読取ることになるが、各TE検出用光センサc,dはそれぞれ各領域S1,S2内に配設されているため、図3に示すように対物レンズ55が中立位置(N)から左右に変位した場合(L)(R)においても、各TE検出用光センサc,dは常に反射光ファーフィールドパターン内における0次回折光と1次回折光が重複している位置に存在することになり、誤差増幅器2からは常に直流オフセットが存在しないTE信号を得られる。これは、光ディスク56が図9のように傾斜した場合についても同様であり、直流オフセットのないTE信号による正確なトラッキング制御を可能にする。

【0018】次に、図2は第2の実施例に係るTS用光検出器の平面図及び信号検出回路を示す。同図において、11はTS用光検出器であり、その受光面にはフォトダイオードであるTE検出用光センサc,dと位置調整用光センサe,f,g,hが配設されている。そして、各TE検出用光センサc,dの出力は誤差増幅器12に接続されているが、各位置調整用光センサe,f,g,hの出力については、センサe,fの出力が加算回路13に、センサg,hの出力が加算回路14に、センサe,gの出力が加算回路15に、センサf,hの出力が加算回路16に接続されており、更に加算回路13,14の出力が誤差増幅器17に、加算回路15,16の出力が誤差増幅器18に接続された回路構成を有している。

【0019】また、このTS用光検出器11における各光センサc,d,e,f,g,hの配設関係は、TE検出用光センサc,dについては前記の実施例1の場合と同様であるが、位置調整用光センサe,f,g,hについては、TE検出用光センサc,dの中心を結ぶ線分とその線分の中点において直交する線分で4分割された領域に配設されている。

【0020】この実施例においては、TS用光検出器11の最高感度位置への調整を位置調整用光センサe,f,g,hのみで行い、実施例1のようにTE検出用光センサc,dを用いない。即ち、前記の実施例1と同様にTS用光検出器11を仮止めした状態で、各位置調整用光センサe,f,g,hの出力をVe,Vf,Vg,Vhとすると、誤差増幅器17からはX軸方向の調整信号として$Vx=(Ve+Vf)-(Vg+Vh)$が、誤差増幅器18からはY軸方向の調整信号として$Vy=(Ve+Vg)-(Vf+Vh)$が得られるが、これらの調整信号Vx,Vyが双方とも0になるようにTS用光検出器11の位置を調整する。そして、調整用光ディスクの反射光ファーフィールドパターンが前記のような対称性を有した光量分布を呈することから、$Vx=Vy=0$の状態において、各TE検出用光センサc,dの中心を結ぶ線分の中点に反射光ファーフィールドパターンの中心を合致させることができ、その位置でTS用光検出器11を固定することにより最高感度でのTE検出が可能になる。尚、この実施例ではTS用光検出器11に4分割PDを用いていることになるが、原理的には3分割以上のPDを用いれば前記の調整を行うことが可能である。

【0021】また、この実施例において通常の光ディスク56を読取った場合にも、各TE検出用光センサc,dはそれぞれ対物レンズ55の変位や光ディスク56の傾斜を考慮して0次回折光と1次回折光が重複する領域S1,S2内に配設されているため、常に直流オフセットの存在しないTE信号を検出できることになる。

【0022】

【発明の効果】本発明の光ディスク読取り装置におけるトラッキング誤差検出方式は、以上の構成を有していることにより、プッシュプル方式によるTE信号検出感度を最高に設定するためのTS用光検出器の位置調整を容易すると共に、TE検出用センサを結像光学系と誤差検出光学系の間で光軸の不一致が生じた場合にも光ディスクからの反射光ファーフィールドパターン内で0次回折光と1次回折光が重複すると想定される2領域内に設けていることにより、対物レンズの変位や光ディスクの傾斜が生じてもTE信号に直流オフセットが発生することを防止で

き、光ピックアップに対する正確なトラッキング制御を可能にする。

【図面の簡単な説明】

【図1】本発明の光ディスク読取り装置におけるトラッキング誤差検出方式に係る第1の実施例に対応したTS用光検出器の平面図及び信号検出回路である。

【図2】第2の実施例に対応したTS用光検出器の平面図及び信号検出回路である。

【図3】対物レンズが変位した場合にTS用光検出器の受光面に構成される反射光ファーフィールドパターンとTE信号検出用光センサの位置関係を示す図である。

【図4】TE信号の検出にプッシュプル方式を適用した場合の光ディスク読取り装置の光学的構成を示す図である。

【図5】プッシュプル方式によるTE信号検出原理を示す図である。

【図6】プッシュプル方式によるTE信号検出原理を示す図である。

【図7】光ピックアップの移動に対応したTE信号の変化(直流オフセットの発生がない状態)を示すグラフである。

【図8】対物レンズが変位した場合におけるTS用光検出器の受光面に構成される反射光ファーフィールドパターンの変化の態様を示す図である。

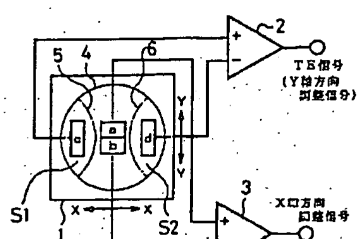
【図9】光ディスクが傾斜した場合におけるTS用光検出器の受光面に構成される反射光ファーフィールドパターンの変化の態様を示す図である。

【図10】光ピックアップの移動に対応したTE信号の変化(直流オフセット発生状態)を示すグラフである。

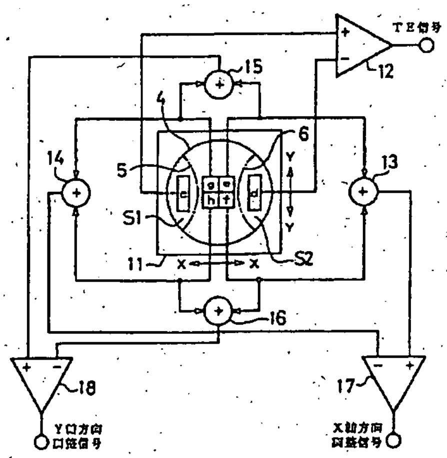
【符号の説明】

1,11…TS用光検出器、2,3,12,17,18…誤差増幅器、4…0次回折光パターン、5,6…1次回折光パターン、13,14,15,16…加算回路、a,b,e,f,g,h…位置調整用光センサ、c,d…TE検出用光センサ、S1,S2…0次回折光と1次回折光が常時重複する領域。

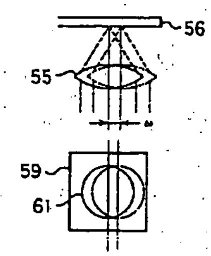
【図1】



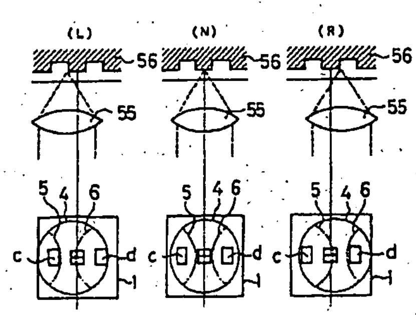
【図2】



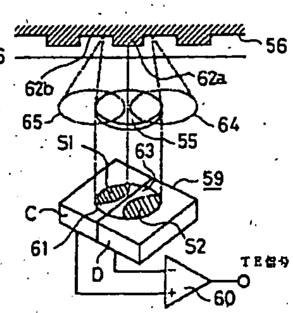
【図8】



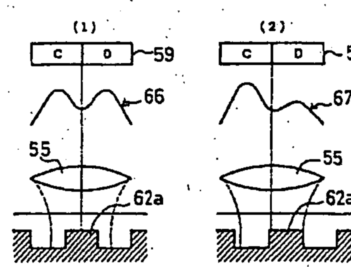
【図3】



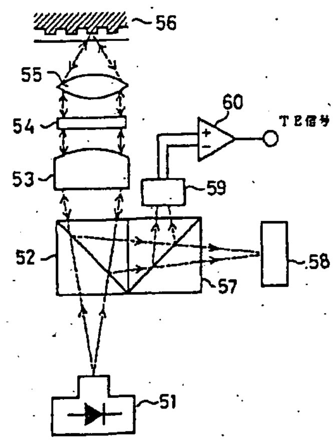
【図5】



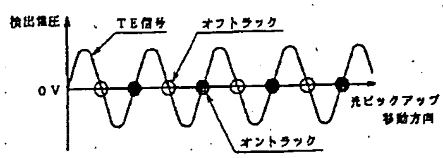
【図6】



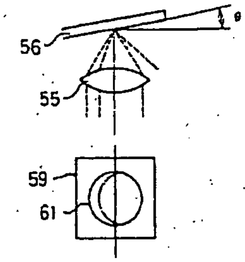
【図4】


56
55
54
53
52
51
57
58
59
60
TE信号

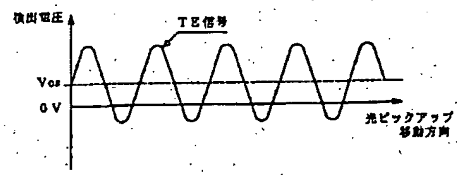
【図7】


検出電圧
TE信号
オフトラック
0V
光ピックアップ移動方向
オントラック

【図9】


56
θ
55
59
61

【図10】


検出電圧
TE信号
Vos
0V
光ピックアップ移動方向

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-006564
(43)Date of publication of application : 14.01.1993

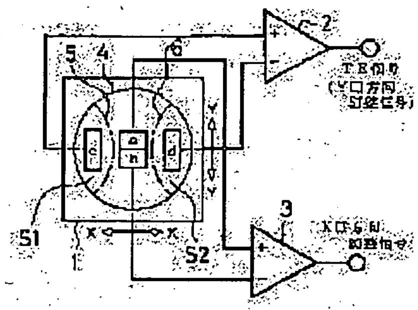
(51)Int.Cl. G11B 7/095

(21)Application number : 03-183443
(22)Date of filing : 28.06.1991

(71)Applicant : VICTOR CO OF JAPAN LTD
(72)Inventor : OOTA MITSUHIKO
IMAMURA YOSHINAGA
KANEDA NOBUYUKI

(54) TRACKING ERROR DETECTING SYSTEM IN OPTICAL DISK READER

(57)Abstract:
PURPOSE: To provide a tracking error (TE) detecting system in an optical disk reader which detects TE signals with a high sensitivity during the detection of TE signals by a push-pull method and prevents the generation of a direct current offset caused by a displacement of an objective lens and a tilt of the optical disk.



CONSTITUTION: TE detecting light sensors (c) and (d) are placed within regions S1 and S2, in which zero th-order diffracted light beams and first-order diffracted light beams of reflected far field pattern are superimposed, when an objective lens displacement against the light receiving surface of a tracking servo light detector 1 is generated. Furthermore, position adjusting light sensors (a) and (b)are placed in the center portion between the sensors (c) and (d) along the orthogonal direction of these sensors and make a position adjustment of the light detector 1 so that the output error amplifiers 2 and 3, which amplify the output difference of the sensors (c) and (d) and the sensors (a) and (b) becomes zero then, drive the tracking servo with the output of the error amplifier 2 as TE signals.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision

of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] In the optical disk reader which detects a tracking-error signal with a push pull method As opposed to the light-receiving side of the light sensitive cell for tracking servos When the inequality of an optical axis arises between image formation optical system and error detection optical system, while arranging the photosensor for tracking-error detection, respectively in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk Two photosensors for position detection divided by the segment which connects the center of those photosensors to the central field between each aforementioned photosensor are arranged. Adjustment fixation of the position of the light sensitive cell for tracking servos is carried out to make the middle point of the aforementioned segment agree at the center of a reflected light far field pattern with reference to each quantity of light detecting signal of the photosensor for tracking-error detection, and the photosensor for position detection. The tracking-error detection method in the optical disk reader characterized by detecting a tracking error using each quantity of light detecting signal of the photosensor for tracking-error detection.
[Claim 2] In the optical disk reader which detects a tracking-error signal with a push pull method As opposed to the light-receiving side of the light sensitive cell for tracking servos When the inequality of an optical axis arises between image formation optical system and error detection optical system, while arranging the photosensor for tracking-error detection, respectively in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk The photosensor for position detection by which hyperfractionation was carried out more than trichotomy is arranged in the central field between each aforementioned photosensor. Adjustment fixation of the position of the light sensitive cell for tracking servos is carried out to make the middle point of a segment to which the center of each photosensor for tracking-error detection is connected with reference to the quantity of light detecting signal of each photosensor for position detection agree at the center of a reflected light far field pattern. The tracking-error detection method in the optical disk reader characterized by detecting a tracking error using each quantity of light detecting signal of the photosensor for tracking-error detection.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the tracking-error detection method in an optical disk reader, and in the optical disk unit which detects a tracking-error (TE) signal by the push pull method by the single beam, while detecting TE signal by high sensitivity, it aims at offering the method which does not generate a direct current offset.
[0002]
[Description of the Prior Art] In order to maintain the framing error rate (FER) property of the regenerative signal by the truck following error of a laser beam at below predetermined, the tracking-servo (TS) system is incorporated, and after the disk has carried out eccentricity, even if it operates, the laser beam of an optical pickup is made to trace correctly along a truck (1.6-micrometer interval) in an optical disk reader. Although there are a single beam system and 3 beam methods as detection method of this TE signal and there are various kinds of signal-processing methods also in each method further, about a pulley groove's existence check and efficiency for light utilization, it can be called the method by composition with the simplest push pull method.
[0003] And optical composition as shows the optical disk reader at the time of applying the aforementioned push pull method as an example to drawing 4 may be adopted. In this drawing, after the laser beam irradiated from the light source (laser diode) 51 passes a beam splitter (BS) 52, serves as parallel light by the collimator lens 53 and passes 1/4 wavelength plate 54, it has a focus extracted and connects the beam spot with an objective lens 55 to the reflector of the optical disk 56 which is an information record medium. On the other hand, although the reflected light from an optical disk 56 returns from an objective lens 55 to BS52 through 1/4 wavelength plate 54 and a collimator lens 53 conversely Although BS52 is made to be shot ON to BS57 which was made to change 90 degrees of angles of the return light, and adjoined and carries out incidence image formation of a part of the incident light to the light sensitive cell 58 for regenerative-signal detection as it is in BS57, it makes 90 degrees of angles change further about a part of other incident lights, and carries out incidence to the light sensitive cell 59 for TS.
[0004] By the push pull method, the aforementioned light sensitive cell 59 consisted of a 2 division photodetector (PD), amplified the output difference of each photodiode C and D with the error amplifier 60, and has acquired TE signal. Here, the principle of this method is explained in detail using drawing 5 and drawing 6 . Although the reflected light from an optical disk 56 forms the far field pattern 61 in the light-receiving side of a light sensitive cell 59 through the aforementioned optical system from an objective lens 54 By forming groove (or pit) 62a in the front face of an optical disk 56 The duplication fields (slash field) S1 and S2 with the primary diffracted lights 64 and 65 at which carried out incidence to the zero-order diffracted light 63 directly reflected by the far field pattern 61 by groove (or pit) 62a to land 62b, and the wave front turned are formed. And since the quantity of light distribution of the duplication fields S1 and S2 changes a lot by the interference effect of the light by existence of groove (or pit) 62a, it can detect TE by arranging Photodiodes C and D in each fields S1 and S2. The quantity of light distribution of the light-receiving side of a light sensitive cell 59 becomes symmetrical like [as shown in (1) of drawing 6 , when the beam spot is in the center position of groove (or pit) 62a] a distribution curve (or when it is at the center of land 62b) 66, and TE signal is set to 0V. namely, on the other hand As shown in (2) of drawing 6 , when

the beam spot is in the position which shifted from groove (or pit) 62a, it becomes unsymmetrical like a distribution curve 67, and TE signal serves as EV (E!=0). Consequently, as shown in drawing 7 , along with movement of an optical pickup, TE signal will change focusing on 0V, and the position where TE signal becomes 0V will show an on-truck and an off-track by turns.

[0005]

[Problem(s) to be Solved by the Invention] By the way, it is materialized on the assumption that the optical axis of the aforementioned principle of the image formation optical system in drawing 4 and error detection optical system corresponds completely, and if an inequality is in those opticals axis, a direct current offset will occur to TE signal. For example, as shown in drawing 8 , when the objective lens 55 is carrying out the variation rate (variation rate amount : omega) to the left or the right from the neutral state (state which is in a regular position with optical system), the far field pattern 61 will shift in respect of light-receiving of a light sensitive cell 59, and a direct current offset will appear in TE signal. Moreover, if the disk 56 inclines from the orthotomic surface of the optical axis of an objective lens 55 as shown in drawing 9 (tilt angle : theta), the optical axis of the reflected light will shift and the same result will be caused. That is, as TE signal is shown in drawing 10 , it comes to change focusing on offset voltage Vos, and the irradiation beam will be located at the center of a truck even if the signal shows 0V.

[0006] Furthermore, although the method of adjusting while it is necessary to double the center (middle point of the parting line of Photodiodes C and D) of the 2 division PD with the center of a far field pattern for making sensitivity of TE signal high, and referring to the output of each photodiodes C and D of a light sensitive cell 59 from the former is adopted Although it is easy to double the center of a far field pattern on a parting line according to the method, it is difficult for you to make it located in the middle point of the parting line. That is, if the center of a far field pattern is on the aforementioned parting line, since each photodiodes C and D always serve as the same output, it cannot ask to the middle point of a parting line, but when the optical axis of the reflected light and the middle point of a parting line are not in agreement on a parting line, the sensitivity of a light sensitive cell 59 will fall.

[0007] Then, this invention was created in the optical disk reader which detects TE signal by the push pull method for the purpose of offering TE detection method which the light sensitive cell for TS always detects TE signal by high sensitivity, and a direct current offset does not generate to the TE signal.

[0008]

[Means for Solving the Problem] In the optical disk reader to which the 1st invention detects a tracking-error signal with a push pull method As opposed to the light-receiving side of the light sensitive cell for tracking servos When the inequality of an optical axis arises between image formation optical system and error detection optical system, while arranging the photosensor for tracking-error detection, respectively in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk Two photosensors for position detection divided by the segment which connects the center of those photosensors to the central field between each aforementioned photosensor are arranged. Adjustment fixation of the position of the light sensitive cell for tracking servos is carried out to make the middle point of the aforementioned segment agree at the center of a reflected light far field pattern with reference to each quantity of light detecting signal of the photosensor for tracking-error detection, and the photosensor for position detection. The tracking-error detection method in the optical disk reader characterized by detecting a tracking error using each quantity of light detecting signal of the photosensor for tracking-error detection is started.

[0009] Moreover, about the arrangement conditions of the photosensor for TE detection to the light-receiving side of the light sensitive cell for TS, although the 2nd invention is the same as that of the 1st invention That by which hyperfractionation was carried out about the photosensor for position detection more than trichotomy is made to arrange in the central field between the photosensors for TE detection. Adjustment fixation of the position of the light sensitive cell for TS is carried out to make the middle point of a segment to which the center of each photosensor for TE detection is connected with reference to the quantity of light detecting signal of each photosensor for position detection agree at the center of a reflected light far field pattern. TE detection method in the optical

disk reader characterized by detecting TE using each quantity of light detecting signal of the photosensor for TE detection is started.
[0010]
[Function] The middle point which faces adjusting the position of the light sensitive cell for TS in the 1st invention, and starts in the arrangement direction of the sensor using the quantity of light detecting signal of each photosensor for TE detection It can ask for the middle point which starts in the direction which intersects perpendicularly in the aforementioned arrangement direction with reference to each quantity of light detecting signal of the photosensor for position detection, and the highest sensitivity position (position equivalent to the center of symmetry of both photosensors for TE detection) of the light sensitive cell for TS can be made to agree at the center of a far field pattern.
[0011] In the 2nd invention, on the occasion of the aforementioned positioning, the photosensor for TE detection does not use but adjusts the center of a far field pattern to the highest sensitivity position only using the photosensor for position detection. That is, if each quantity of light detecting signal of the photosensor for position detection more than trichotomy is used, positioning will be possible [it becomes possible to pinpoint the highest sensitivity position on a flat surface, and], without using the photosensor for TE detection.
[0012] And in both invention, since the sensor for TE detection is located in consideration of the case where the far field pattern shifted by the variation rate of an objective lens, or the inclination of an optical disk, or the optical axis of the reflected light shifts, in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within a reflected light far field pattern, it becomes possible by processing the signal of the photosensor for TE detection by the push pull method to always detect only TE component. That is, it can prevent that a direct current offset arises to TE signal.
[0013]
[Example] Hereafter, the example of this invention is explained using drawing 3 from drawing 1 . Drawing 1 shows the plan and signal-detection circuit of the light sensitive cell for TS in the optical disk reader concerning the 1st example. In this drawing, 1 is a light sensitive cell for TS, the photosensors c and d for TE detection and the photosensors a and b for justification which are photodiodes are arranged in the light-receiving side, the output of each photosensors c and d for TE detection is connected to the error amplifier 2, and the output of each photosensors a and b for justification is connected to the error amplifier 3. Moreover, in drawing 1 , the direction of X-X shows the truck transection direction by the optical relation with an optical disk flat surface, and the direction of Y-Y shows the direction of a truck.
[0014] In this light sensitive cell 1 for TS, the arrangement relation of each photosensors c, d, a, and b is as follows. If the displacement range of an objective lens and the inclination range of an optical disk are assumed where the light sensitive cell 1 for TS is attached in a regular position, first, by analyzing the optical system of an optical disk reader Although two fields S1 and S2 which the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk though the aforementioned variation rate and aforementioned inclination in the range are on the light-receiving side can be assumed Each photosensors c and d for TE detection are arranged in the two aforementioned fields S1 and S2, respectively. In addition, in drawing 1 , 4, and 5 and 6 show the pattern of the zero-order diffracted light and the primary diffracted light, respectively.
[0015] On the other hand, the photosensors a and b for justification are arranged in the center section of the field constituted among each aforementioned photosensors c and d for TE detection in the mode divided by the segment which connects the center of each photosensors c and d for TE detection.
[0016] In the optical disk reader shown in drawing 4 the light sensitive cell 1 for TS of drawing 1 instead of the conventional light sensitive cell 59 for TS Therefore, a tacking meal, If the position of the light sensitive cell 1 for TS is adjusted so that each output of the error amplifier 2 and 3 may be set to 0V in the state where the optical disk for adjustment with which a truck does not exist was made to read The center of a reflected light far field pattern can be made to agree on the middle point of a segment to which the center of each photosensors c and d for TE detection is connected, and it

comes to be able to perform TE detection by the highest sensitivity. Namely, the output of the error amplifier 2 can use the output of the error amplifier 3 as an adjustment signal of X shaft orientations as an adjustment signal of Y shaft orientations. In the reflected light far field pattern of the optical disk for adjustment, it becomes the maximum quantity of light at the center. And on a surrounding concentric circle, since it is in a quantity of light distribution state which is decreased as it keeps away from a center, the highest sensitivity will be obtained in the position where each output of the error amplifier 2 and 3 becomes 0V. In addition, as a concrete adjustment means, the position of the light sensitive cell 1 for TS will be finely tuned using a justification fixture, measuring the output voltage of the error amplifier 2 and 3 with a voltmeter or an oscilloscope.

[0017] Although full fixation of the light sensitive cell 1 for TS will be carried out in the state at the assembly mechanism of an optical pickup and the usual optical disk will be read when positioning of the light sensitive cell 1 for TS is completed as it is the above Since each photosensors c and d for TE detection are arranged in each field S1 and S2, respectively, As shown in drawing 3 , when an objective lens 55 displaces right and left from a center valve position (N), it also sets to (L) and (R). Each photosensors c and d for TE detection will exist in the position where the zero-order diffracted light and the primary diffracted light in a reflected light far field pattern always overlap, and can acquire TE signal with which a direct current offset always does not exist from the error amplifier 2. This is the same also about the case where an optical disk 56 inclines like drawing 9 , and makes possible exact tracking control by TE signal without a direct current offset.

[0018] Next, drawing 2 shows the plan and signal-detection circuit of the light sensitive cell for TS concerning the 2nd example. In this drawing, 11 is a light sensitive cell for TS, and the photosensors c and d for TE detection and the photosensors e, f, g, and h for justification which are photodiodes are arranged in the light-receiving side. And although the output of each photosensors c and d for TE detection is connected to the error amplifier 12 About the output of each photosensors e, f, g, and h for justification The output of Sensors g and h to an adder circuit 13 to an adder circuit 14 [the output of Sensors e and f] The output of Sensors e and g is connected to an adder circuit 15, the output of Sensors f and h is connected to the adder circuit 16, and it has circuitry by which the output of adder circuits 13 and 14 was connected to the error amplifier 17, and the output of adder circuits 15 and 16 was further connected to the error amplifier 18.

[0019] Moreover, although the arrangement relation of each photosensors c, d, e, f, g, and h in this light sensitive cell 11 for TS is the same as that of the case of the aforementioned example 1 about the photosensors c and d for TE detection It is arranged in the field quadrisected by the segment which connects the center of the photosensors c and d for TE detection, and the segment which intersects perpendicularly at the middle point of the segment about the photosensors e, f, g, and h for justification.

[0020] In this example, adjustment to the highest sensitivity position of the light sensitive cell 11 for TS is performed only by the photosensors e, f, g, and h for justification, and the photosensors c and d for TE detection are not used like an example 1. The light sensitive cell 11 for TS in namely, the state where it carried out [tacking], like the aforementioned example 1 If the output of each photosensors e, f, g, and h for justification is set to Ve, Vf, Vg, and Vh Although Vx=(Ve+Vf)-(Vg+Vh) is obtained from the error amplifier 17 as an adjustment signal of X shaft orientations and Vy=(Ve+Vg)- (Vf+Vh) is obtained from the error amplifier 18 as an adjustment signal of Y shaft orientations As for both sides, these adjustment signals Vx and Vy adjust the position of the light sensitive cell 11 for TS so that it may be set to 0. And since the reflected light far field pattern of the optical disk for adjustment presents the quantity of light distribution with the above symmetric property, in the state of Vx=Vy=0, the center of a reflected light far field pattern can be made to agree on the middle point of a segment to which the center of each photosensors c and d for TE detection is connected, and TE detection by the highest sensitivity is attained by fixing the light sensitive cell 11 for TS in the position. In addition, although quadrisection PD will be used for the light sensitive cell 11 for TS in this example, if PD more than trichotomy is used theoretically, it is possible to perform the aforementioned adjustment.

[0021] Moreover, since each photosensors c and d for TE detection are arranged in the field S1 where the zero-order diffracted light and the primary diffracted light overlap in consideration of the variation rate of an objective lens 55, or the inclination of an optical disk 56, respectively, and S2

when the usual optical disk 56 is read in this example, TE signal with which a direct current offset always does not exist can be detected.

[0022]

[Effect of the Invention] The tracking-error detection method in the optical disk reader of this invention While carrying out easy [of the positioning of the light sensitive cell for TS for setting TE signal-detection sensitivity by the push pull method as the highest by having the above composition] By having prepared in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk when the inequality of an optical axis produces the sensor for TE detection between image formation optical system and error detection optical system Even if the variation rate of an objective lens and the inclination of an optical disk arise, it can prevent that a direct current offset occurs to TE signal, and exact tracking control to an optical pickup is made possible.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] this invention relates to the tracking-error detection method in an optical disk reader, and in the optical disk unit which detects a tracking-error (TE) signal by the push pull method by the single beam, while detecting TE signal by high sensitivity, it aims at offering the method which does not generate a direct current offset.

[Translation done.]

＊NOTICES＊

PRIOR ART

[Description of the Prior Art] In order to maintain the framing error rate (FER) property of the regenerative signal by the truck following error of a laser beam at below predetermined, the tracking-servo (TS) system is incorporated, and after the disk has carried out eccentricity, even if it operates, the laser beam of an optical pickup is made to trace correctly along a truck (1.6-micrometer interval) in an optical disk reader. Although there are a single beam system and 3 beam methods as detection method of this TE signal and there are various kinds of signal-processing methods also in each method further, about a pulley groove's existence check and efficiency for light utilization, it can be called the method by composition with the simplest push pull method.
[0003] And optical composition as shows the optical disk reader at the time of applying the aforementioned push pull method as an example to drawing 4 may be adopted. In this drawing, after the laser beam irradiated from the light source (laser diode) 51 passes a beam splitter (BS) 52, serves as parallel light by the collimator lens 53 and passes 1/4 wavelength plate 54, it has a focus extracted and connects the beam spot with an objective lens 55 to the reflector of the optical disk 56 which is an information record medium. On the other hand, although the reflected light from an optical disk 56 returns from an objective lens 55 to BS52 through 1/4 wavelength plate 54 and a collimator lens 53 conversely Although BS52 is made to be shot ON to BS57 which was made to change 90 degrees of angles of the return light, and adjoined and carries out incidence image formation of a part of the incident light to the light sensitive cell 58 for regenerative-signal detection as it is in BS57, it makes 90 degrees of angles change further about a part of other incident lights, and carries out incidence to the light sensitive cell 59 for TS.
[0004] By the push pull method, the aforementioned light sensitive cell 59 consisted of a 2 division photodetector (PD), amplified the output difference of each photodiode C and D with the error amplifier 60, and has acquired TE signal. Here, the principle of this method is explained in detail using drawing 5 and drawing 6 . Although the reflected light from an optical disk 56 forms the far field pattern 61 in the light-receiving side of a light sensitive cell 59 through the aforementioned optical system from an objective lens 54 By forming groove (or pit) 62a in the front face of an optical disk 56 The duplication fields (slash field) S1 and S2 with the primary diffracted lights 64 and 65 at which carried out incidence to the zero-order diffracted light 63 directly reflected by the far field pattern 61 by groove (or pit) 62a to land 62b, and the wave front turned are formed. And since the quantity of light distribution of the duplication fields S1 and S2 changes a lot by the interference effect of the light by existence of groove (or pit) 62a, it can detect TE by arranging Photodiodes C and D in each fields S1 and S2. The quantity of light distribution of the light-receiving side of a light sensitive cell 59 becomes symmetrical like [as shown in (1) of drawing 6 , when the beam spot is in the center position of groove (or pit) 62a] a distribution curve (or when it is at the center of land 62b) 66, and TE signal is set to 0V. namely, on the other hand As shown in (2) of drawing 6 , when the beam spot is in the position which shifted from groove (or pit) 62a, it becomes unsymmetrical like a distribution curve 67, and TE signal serves as EV (E!=0). Consequently, as shown in drawing 7 , along with movement of an optical pickup, TE signal will change focusing on 0V, and the position where TE signal becomes

0V will show an on-truck and an off-track by turns.

[Translation done.]

* NOTICES *

EFFECT OF THE INVENTION

[Effect of the Invention] The tracking-error detection method in the optical disk reader of this invention, While carrying out easy [of the positioning of the light sensitive cell for TS for setting TE signal-detection sensitivity by the push pull method as the highest by having the above composition] By having prepared in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk when the inequality of an optical axis produces the sensor for TE detection between image formation optical system and error detection optical system Even if the variation rate of an objective lens and the inclination of an optical disk arise, it can prevent that a direct current offset occurs to TE signal, and exact tracking control to an optical pickup is made possible.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, it is materialized on the assumption that the optical axis of the aforementioned principle of the image formation optical system in drawing 4 and error detection optical system corresponds completely, and if an inequality is in those opticals axis, a direct current offset will occur to TE signal. For example, as shown in drawing 8 , when the objective lens 55 is carrying out the variation rate (variation rate amount : omega) to the left or the right from the neutral state (state which is in a regular position with optical system), the far field pattern 61 will shift in respect of light-receiving of a light sensitive cell 59, and a direct current offset will appear in TE signal. Moreover, if the disk 56 inclines from the orthotomic surface of the optical axis of an objective lens 55 as shown in drawing 9 (tilt angle : theta), the optical axis of the reflected light will shift and the same result will be caused. That is, as TE signal is shown in drawing 10 , it comes to change focusing on offset voltage Vos, and the irradiation beam will be located at the center of a truck even if the signal shows 0V.
[0006] Furthermore, although the method of adjusting while it is necessary to double the center (middle point of the parting line of Photodiodes C and D) of the 2 division PD with the center of a far field pattern for making sensitivity of TE signal high, and referring to the output of each photodiodes C and D of a light sensitive cell 59 from the former is adopted Although it is easy to double the center of a far field pattern on a parting line according to the method, it is difficult for you to make it located in the middle point of the parting line. That is, if the center of a far field pattern is on the aforementioned parting line, since each photodiodes C and D always serve as the same output, it cannot ask to the middle point of a parting line, but when the optical axis of the reflected light and the middle point of a parting line are not in agreement on a parting line, the sensitivity of a light sensitive cell 59 will fall.
[0007] Then, this invention was created in the optical disk reader which detects TE signal by the push pull method for the purpose of offering TE detection method which the light sensitive cell for TS always detects TE signal by high sensitivity, and a direct current offset does not generate to the TE signal.

[Translation done.]

MEANS

[Means for Solving the Problem] In the optical disk reader to which the 1st invention detects a tracking-error signal with a push pull method As opposed to the light-receiving side of the light sensitive cell for tracking servos When the inequality of an optical axis arises between image formation optical system and error detection optical system, while arranging the photosensor for tracking-error detection, respectively in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk Two photosensors for position detection divided by the segment which connects the center of those photosensors to the central field between each aforementioned photosensor are arranged. Adjustment fixation of the position of the light sensitive cell for tracking servos is carried out to make the middle point of the aforementioned segment agree at the center of a reflected light far field pattern with reference to each quantity of light detecting signal of the photosensor for tracking-error detection, and the photosensor for position detection. The tracking-error detection method in the optical disk reader characterized by detecting a tracking error using each quantity of light detecting signal of the photosensor for tracking-error detection is started.
[0009] Moreover, about the arrangement conditions of the photosensor for TE detection to the light-receiving side of the light sensitive cell for TS, although the 2nd invention is the same as that of the 1st invention That by which hyperfractionation was carried out about the photosensor for position detection more than trichotomy is made to arrange in the central field between the photosensors for TE detection. Adjustment fixation of the position of the light sensitive cell for TS is carried out to make the middle point of a segment to which the center of each photosensor for TE detection is connected with reference to the quantity of light detecting signal of each photosensor for position detection agree at the center of a reflected light far field pattern. TE detection method in the optical disk reader characterized by detecting TE using each quantity of light detecting signal of the photosensor for TE detection is started.

[Translation done.]

OPERATION

[Function] In the 1st invention, it faces adjusting the position of the light sensitive cell for TS, and the quantity of light detecting signal of each photosensor for TE detection is used. It can ask for the middle point which starts in the direction which intersects perpendicularly the middle point which starts in the arrangement direction of the sensor in the aforementioned arrangement direction with reference to each quantity of light detecting signal of the photosensor for position detection, and the highest sensitivity position (position equivalent to the center of symmetry of both photosensors for TE detection) of the light sensitive cell for TS can be made to agree at the center of a far field pattern.
[0011] In the 2nd invention, on the occasion of the aforementioned positioning, the photosensor for TE detection does not use but adjusts the center of a far field pattern to the highest sensitivity position only using the photosensor for position detection. That is, if each quantity of light detecting signal of the photosensor for position detection more than trichotomy is used, positioning will be possible [it becomes possible to pinpoint the highest sensitivity position on a flat surface, and], without using the photosensor for TE detection.
[0012] And in both invention, the case where the far field pattern shifted by the variation rate of an objective lens or the inclination of an optical disk, or the optical axis of the reflected light shifts is taken into consideration. Since the sensor for TE detection is located in 2 fields assumed that the zero-order diffracted light and the primary diffracted light overlap within a reflected light far field pattern, it becomes possible by processing the signal of the photosensor for TE detection by the push pull method to always detect only TE component. That is, it can prevent that a direct current offset arises to TE signal.

[Translation done.]

* NOTICES *

EXAMPLE

[Example] Hereafter, the example of this invention is explained using drawing 3 from drawing 1 . Drawing 1 shows the plan and signal-detection circuit of the light sensitive cell for TS in the optical disk reader concerning the 1st example. In this drawing, 1 is a light sensitive cell for TS, the photosensors c and d for TE detection and the photosensors a and b for justification which are photodiodes are arranged in the light-receiving side, the output of each photosensors c and d for TE detection is connected to the error amplifier 2, and the output of each photosensors a and b for justification is connected to the error amplifier 3. Moreover, in drawing 1 , the direction of X-X shows the truck transection direction by the optical relation with an optical disk flat surface, and the direction of Y-Y shows the direction of a truck.
[0014] In this light sensitive cell 1 for TS, the arrangement relation of each photosensors c, d, a, and b is as follows. If the displacement range of an objective lens and the inclination range of an optical disk are assumed where the light sensitive cell 1 for TS is attached in a regular position, first, by analyzing the optical system of an optical disk reader Although two fields S1 and S2 which the zero-order diffracted light and the primary diffracted light overlap within the reflected light far field pattern from an optical disk though the aforementioned variation rate and aforementioned inclination in the range are on the light-receiving side can be assumed Each photosensors c and d for TE detection are arranged in the two aforementioned fields S1 and S2, respectively. In addition, in drawing 1 , 4, and 5 and 6 show the pattern of the zero-order diffracted light and the primary diffracted light, respectively.
[0015] On the other hand, the photosensors a and b for justification are arranged in the center section of the field constituted among each aforementioned photosensors c and d for TE detection in the mode divided by the segment which connects the center of each photosensors c and d for TE detection.
[0016] In the optical disk reader shown in drawing 4 the light sensitive cell 1 for TS of drawing 1 instead of the conventional light sensitive cell 59 for TS Therefore, a tacking meal, If the position of the light sensitive cell 1 for TS is adjusted so that each output of the error amplifier 2 and 3 may be set to 0V in the state where the optical disk for adjustment with which a truck does not exist was made to read The center of a reflected light far field pattern can be made to agree on the middle point of a segment to which the center of each photosensors c and d for TE detection is connected, and it comes to be able to perform TE detection by the highest sensitivity. Namely, the output of the error amplifier 2 can use the output of the error amplifier 3 as an adjustment signal of X shaft orientations as an adjustment signal of Y shaft orientations. In the reflected light far field pattern of the optical disk for adjustment, it becomes the maximum quantity of light at the center. And on a surrounding concentric circle, since it is in a quantity of light distribution state which is decreased as it keeps away from a center, the highest sensitivity will be obtained in the position where each output of the error amplifier 2 and 3 becomes 0V. In addition, as a concrete adjustment means, the position of the light sensitive cell 1 for TS will be finely tuned using a justification fixture, measuring the output voltage of the error amplifier 2 and 3 with a voltmeter or an oscilloscope.
[0017] Although full fixation of the light sensitive cell 1 for TS will be carried out in the state at the assembly mechanism of an optical pickup and the usual optical disk will be read when positioning of the light sensitive cell 1 for TS is completed as it is the above Since each photosensors c and d for TE detection are arranged in each field S1 and S2, respectively., As shown in drawing 3 , when an

objective lens 55 displaces right and left from a center valve position (N), it also sets to (L) and (R). Each photosensors c and d for TE detection will exist in the position where the zero-order diffracted light and the primary diffracted light in a reflected light far field pattern always overlap, and can acquire TE signal with which a direct current offset always does not exist from the error amplifier 2. This is the same also about the case where an optical disk 56 inclines like drawing 9 , and makes possible exact tracking control by TE signal without a direct current offset.

[0018] Next, drawing 2 shows the plan and signal-detection circuit of the light sensitive cell for TS concerning the 2nd example. In this drawing, 11 is a light sensitive cell for TS, and the photosensors c and d for TE detection and the photosensors e, f, g, and h for justification which are photodiodes are arranged in the light-receiving side. And although the output of each photosensors c and d for TE detection is connected to the error amplifier 12 About the output of each photosensors e, f, g, and h for justification The output of Sensors g and h to an adder circuit 13 to an adder circuit 14 [the output of Sensors e and f] The output of Sensors e and g is connected to an adder circuit 15, the output of Sensors f and h is connected to the adder circuit 16, and it has circuitry by which the output of adder circuits 13 and 14 was connected to the error amplifier 17, and the output of adder circuits 15 and 16 was further connected to the error amplifier 18.

[0019] Moreover, although the arrangement relation of each photosensors c, d, e, f, g, and h in this light sensitive cell 11 for TS is the same as that of the case of the aforementioned example 1 about the photosensors c and d for TE detection It is arranged in the field quadrisected by the segment which connects the center of the photosensors c and d for TE detection, and the segment which intersects perpendicularly at the middle point of the segment about the photosensors e, f, g, and h for justification.

[0020] In this example, adjustment to the highest sensitivity position of the light sensitive cell 11 for TS is performed only by the photosensors e, f, g, and h for justification, and the photosensors c and d for TE detection are not used like an example 1. The light sensitive cell 11 for TS in namely, the state where it carried out [tacking], like the aforementioned example 1 If the output of each photosensors e, f, g, and h for justification is set to Ve, Vf, Vg, and Vh Although Vx=(Ve+Vf)-(Vg+Vh) is obtained from the error amplifier 17 as an adjustment signal of X shaft orientations and Vy=(Ve+Vg)- (Vf+Vh) is obtained from the error amplifier 18 as an adjustment signal of Y shaft orientations As for both sides, these adjustment signals Vx and Vy adjust the position of the light sensitive cell 11 for TS so that it may be set to 0. And since the reflected light far field pattern of the optical disk for adjustment presents the quantity of light distribution with the above symmetric property, in the state of Vx=Vy=0, the center of a reflected light far field pattern can be made to agree on the middle point of a segment to which the center of each photosensors c and d for TE detection is connected, and TE detection by the highest sensitivity is attained by fixing the light sensitive cell 11 for TS in the position. In addition, although quadrisection PD will be used for the light sensitive cell 11 for TS in this example, if PD more than trichotomy is used theoretically, it is possible to perform the aforementioned adjustment.

[0021] Moreover, since each photosensors c and d for TE detection are arranged in the field S1 where the zero-order diffracted light and the primary diffracted light overlap in consideration of the variation rate of an objective lens 55, or the inclination of an optical disk 56, respectively, and S2 when the usual optical disk 56 is read in this example, TE signal with which a direct current offset always does not exist can be detected.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the plan and signal-detection circuit of the light sensitive cell for TS corresponding to the 1st example concerning the tracking-error detection method in the optical disk reader of this invention.
[Drawing 2] It is the plan and signal-detection circuit of the light sensitive cell for TS corresponding to the 2nd example.
[Drawing 3] When an objective lens displaces, it is drawing showing the physical relationship of the reflected light far field pattern constituted by the light-receiving side of the light sensitive cell for TS, and the photosensor for TE signal detections.
[Drawing 4] It is drawing showing the optical composition of the optical disk reader at the time of applying a push pull method to detection of TE signal.
[Drawing 5] It is drawing showing TE signal-detection principle by the push pull method.
[Drawing 6] It is drawing showing TE signal-detection principle by the push pull method.
[Drawing 7] It is the graph which shows change (state without generating of a direct current offset) of TE signal corresponding to movement of an optical pickup.
[Drawing 8] It is drawing showing the mode of change of the reflected light far field pattern constituted by the light-receiving side of the light sensitive cell for TS at the time of displacing an objective lens.
[Drawing 9] It is drawing showing the mode of change of the reflected light far field pattern constituted by the light-receiving side of the light sensitive cell for TS at the time of inclining an optical disk.
[Drawing 10] It is the graph which shows change (direct-current-offset generating state) of TE signal corresponding to movement of an optical pickup.
[Description of Notations]
1 11 [-- A zero-order diffracted-light pattern, 5, a 6--primary diffracted-light pattern 13, 14, 15, 16 / -- An adder circuit, a, b, e, f, g, h / -- The photosensor for justification, c, the photosensor for d--TE detection, S1, S2 / -- Field where the zero-order diffracted light and the primary diffracted light always overlap.] -- The light sensitive cell for TS, 2, 3, 12, 17, 18 -- Error amplifier, 4

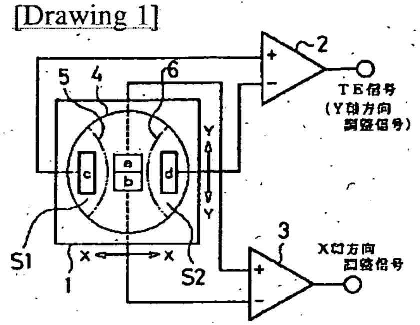
[Translation done.]

* NOTICES *

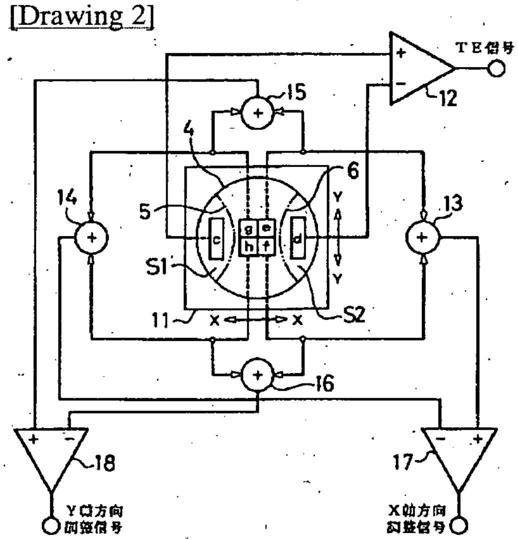
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

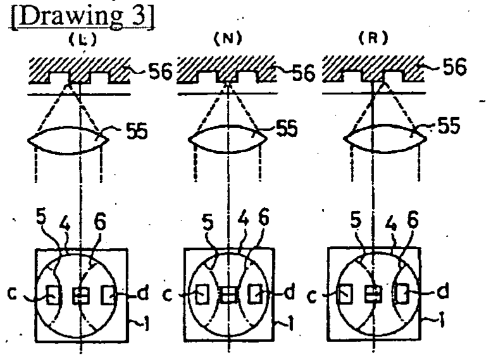
[Drawing 1]



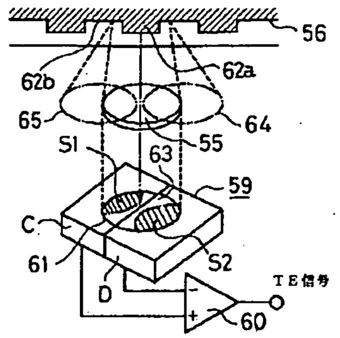
[Drawing 2]



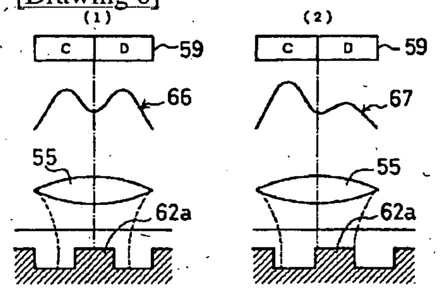
[Drawing 3]



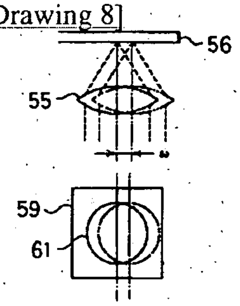
[Drawing 5]



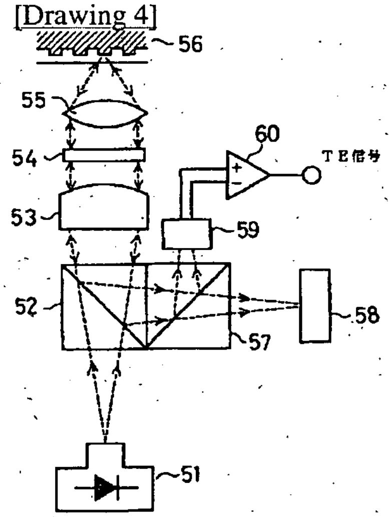
[Drawing 6]



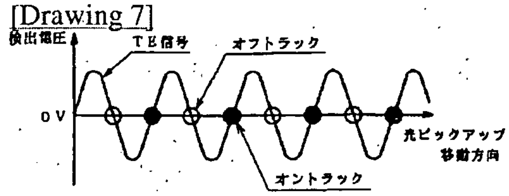
[Drawing 8]



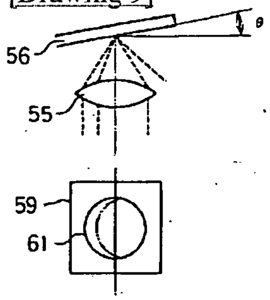
[Drawing 4]



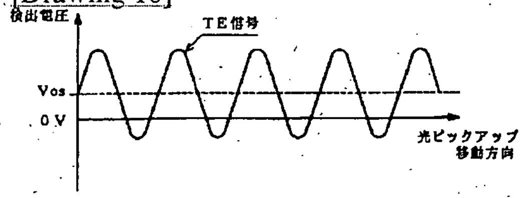
[Drawing 7]



[Drawing 9]



[Drawing 10]



[Translation done.]